REMARKS

In view of the above amendments and the following remarks, reconsideration of the objections and rejections contained in the Office Action of May 7, 2003 is respectfully requested.

As an initial matter, the substitute specification filed on November 8, 2002 has been amended as indicated above to correct a obvious editorial mistake. No new matter has been added by these changes, and the Examiner is respectfully requested to enter these amendments to the specification.

The Examiner has objected to the drawings because Figure 5 appears to show an inconsistency in the fluid flow direction. In order to correct this matter, a new formal Figure 5 has been prepared and submitted herewith. In particular, the direction of the arrows on the right side of Figure 5 have been corrected in order to clarify the direction of the fluid flow through the plate heat exchanger. It is submitted that these changes have been made only to correct an obvious editorial mistake, and no new matter has been added. Therefore, the Examiner is respectfully requested to enter the new formal Figure 5.

Claims 1-20 have been cancelled, and claims 21-38 were submitted in the Amendment filed November 8, 2002. The Examiner has indicated that claims 33-38 have been withdrawn in view of the Applicants' election of February 11, 2003, and these non-elected claims have now been cancelled as indicated above. Remaining claims 21-32 have been rejected by the Examiner in view of the prior art. In particular, independent claim 21 has been rejected as being anticipated by the Damsohn reference (USP 5,718,286) or the Matsunaga reference (USP 5,392,849); independent claim 27 has been rejected as being unpatentable over the Kawai reference (JP 403008561); and independent claim 30 has been rejected as being anticipated by the Furukawa reference (JP 62-258992). In addition, the dependent claims have been rejected as being unpatentable over a combination of one or more of the above references, as well as the Katagiri reference (JP 401014595).

However, independent claim 21 has now been amended to incorporate the subject matter of dependent claim 22, and the Examiner's rejections of the amended and previously-presented claims are respectfully traversed for the reasons set forth below. Furthermore, because independent claim 21 has been amended merely to incorporate the subject matter of a dependent claim, it is submitted

that this amendment does not raise any new issues, and the Examiner is respectfully requested to enter this amendment.

Amended independent claim 21 is directed to a plate heat exchanger that comprises a pair of end plates, a plurality of first passageway plates each having a first passageway defined therein, and a plurality of second passageway plates each having a second passageway defined therein. The first passageway plates and the second passageway plates are stacked in an alternating manner, and one of a plurality of partition plates is interposed between adjacent first passageway plates and second passageway plates. The first passageway of each of the first passageway plates and the second passageway of each of the second passageway plates *are aligned* so that a fluid flowing through the first passageway flows in a manner that is countercurrent to the flow of a second fluid flowing through the second passageway. A partition member is arranged in *only the first passageway* of each of the first passageway plates so as to divide the first passageway into two sections with respect to a width-wise direction of the first passageway.

As explained in paragraph 25 on page 6 of the substitute specification, providing a partition in the first passageway reduces the cross-sectional area of the passageway so as to thereby increase the speed (rate) of the fluid flowing through the passageway. This increased fluid flow rate, in combination with the alignment of the first passageways and the second passageways, serves to increase the heat transfer efficiency. In addition, the partition provided in the first passageway increases the mechanical strength of the heat exchanger, so that the performance and reliability of the plate heat exchanger is further enhanced. Finally, by providing a partition member in *only* the first passageway while aligning the first passageway and the second passageway, the overall weight of the plate heat exchanger is decreased while still having the increased mechanical strength as discussed above. Furthermore, the speed of the fluid flowing through the first passageway can be increased relative to the speed of the fluid flowing through the second passageway so as to provide further control over the overall heat transfer coefficient of the heat exchanger.

The Examiner asserts that the Matsunaga and the Damsohn reference each disclose all of the claimed limitations except the partition member being located in only the first passageway. Thus, although the Examiner has not provided an explanation as to how the Damsohn reference and the

Matsunaga reference disclose each of the claim limitations, it is apparently the Examiner's position that the Damsohn reference and the Matsunaga reference each disclose a plate heat exchanger in which a first passageway of each of the first passageway plates and a second passageway of each of the second passageway plates *are aligned* when the plates are stacked. However, it is submitted that neither the Damsohn reference or the Matsunaga reference disclose this feature as explained below.

With respect to the Matsunaga reference, the Examiner refers to Figures 1-5. Figure 5 illustrates that passageway plates 2, 4 are arranged in an alternating manner with one of the partition plates 3 interposed between adjacent passageway plates 2, 4. Each of the passageway plates 2 shown in Figure 2 includes passageways 11 formed therein, and each of the passageway plates 4 shown in Figure 4 include passageways 16 formed therein. However, it is clear from Figures 2 and 4 of the Matsunaga reference that the passageways 11 of passageway plate 2 are shaped differently and are not aligned with passageways 16 of passageway plate 4 when the passageway plates are stacked in an alternating manner as shown in Figure 5.

Similarly, the Damsohn reference discloses a heat transfer device including a first embodiment with passageway plates 1 (see Figure 1), or a second embodiment with passageway plates 70 (see Figure 7). However, the Damsohn reference explains that the passageway plates 1 are arranged so as to be rotated by 90 degrees with respect to adjacent passageway plates 1 (see column 3, lines 61-66), and explains that the passageway plates 70 are flipped or reversed by 180 degrees with respect to adjacent passageway plates 70 (see column 7, lines 51-55). Due to these arrangements, it is evident that the passageways will not be aligned. Thus, the Matsunaga reference and the Damsohn reference does not disclose or suggest a plate heat exchanger in which first passageways *are aligned with* second passageways.

Moreover, the Examiner acknowledges that the Damsohn reference and the Matsunaga reference do not disclose a partition member arranged *only in the first passageway* of the first passageway plates. Nonetheless, the Examiner asserts that this arrangement would be obvious because the omission of an element and its function in a combination where the remaining elements *perform the same function* as before involves only routine skill in the art. However, as explained above, the partition member (or lack thereof) will affect the speed of the fluid flowing through the

passageways. Thus, if only the first passageway is provided with a partition member, then the speed of the fluid flowing through the first passageway will be increased with respect to the fluid flowing through the second passageway (as compared to an embodiment in which neither passageway has a partition member), thereby affecting the overall heat transfer coefficient of the plate heat exchanger. Moreover, providing a partition member in only one passageway provides increased mechanical strength while minimizing the increased weight of the plate heat exchanger. As a result, it is submitted that providing the partition member in only the first passageway is not a mere "omission of an element and its function" as suggested by the Examiner, and that the remaining elements of the plate heat exchanger would *not* function as before.

The Furukawa reference, the Kawai reference, and the Katagiri reference also do not disclose or suggest a plate heat exchanger as recited in amended independent claim 21, including first passageways *aligned with* second passageways, and in which a partition member is arranged in only the first passageway of each of the first passageway plates. Therefore, one of ordinary skill in the art would not be motivated to modify or combine the references so as to obtain the invention recited in amended independent claim 21. Accordingly, it is respectfully submitted that amended independent claim 21 and the claims that depend therefrom are clearly patentable over the prior art of record.

Independent claim 27 is directed to a method of making a plate heat exchanger, in which two fluid passageways are formed in a plurality of plates by pressing against a first surface of each of the plates towards a second surface of each of the plates. Solder paste is coated on the first surface of each of the plates, and the plates are stacked so that the second surface of each of the plates does not adjoin the second surface of an adjacent plate. Thus, the plates are oriented in the same direction with respect to the first surface and second surface of each of the plates. The plates are then heated while holding the plates in close contact with each other so as to form the plate heat exchanger.

Performing the shaping of the plates by pressing allows the plates to be formed quickly and efficiently. Unfortunately, the pressing process often forms burrs on the "far" surface of the plate. In other words, if the pressing is conducted against the first surface toward the second surface of each of the plates as recited in claim 27, the burrs will be formed on the second surface. As a result, the present invention provides a method in which solder paste is coated *on the first surface* (i.e., the

surface on which the burrs are not likely to be formed). Thus, potential damage to a solder paste-applying jig due to contact with the burrs can be prevented. In addition, because the plates are stacked so that the second surface of each plate does not adjoin a second surface of an adjacent plate, the potential for burrs formed on the second surface of one plate contacting burrs formed on the second surface of an adjacent plate during the stacking process is eliminated, so that any gap formed between the plates will be minimized thereby reducing the potential for poor bonding of the plates.

The Examiner asserts that the Kawai references discloses all of the limitations of independent claim 27, except coating with solder paste. In this regard, the Applicants note that the Kawai reference teaches that a brazing material layer is formed on a surface that will receive burrs (i.e., the second surface), and these burrs can then be eliminated by heating. The Kawai reference, however, does not disclose or suggest coating solder paste on the first surface of each of the plates (i.e., the surface that is pressed *against*). In addition, the Kawai reference also does not disclose or suggest stacking the plates as recited in independent claim 27 because the formation of a permanent gap caused by burrs formed on adjacent surfaces of the plates in not a concern due to the burrs eventually being eliminated by heating. As a result, it is respectfully submitted that the Kawai reference does not disclose or even suggest the invention recited in independent claim 27.

The Damsohn reference, the Matsunaga reference, the Furukawa reference, and the Katagiri reference also do not disclose or suggest a method including coating solder paste on the first surface (i.e., the pressed surface) of each of the plates, and then stacking the plates as recited in independent claim 27. Therefore, one of ordinary skill in the art would not be motivated to modify or combine the references so as to obtain the invention recited in independent claim 27. Accordingly, it is respectfully submitted that independent claim 27 and the claims that depend therefrom are clearly patentable over the prior art of record.

New independent claim 30 is directed to a plate heat exchanger that comprises a pair of end plates, a plurality of first passageway plates each having a first passageway defined therein, and a plurality of second passageway plates each having a second passageway defined therein. The first passageway plates and the second passageway plates are stacked in an alternating manner with one of a plurality of partition plates interposed between adjacent first passageway plates and second

passageway plates, and the first passageways and the second passageways are aligned. The first passageways and the second passageways have a generally U-shaped turning portion, and at least one of the first passageway and the second passageway have a *substantially uniform width* along a lengthwise direction thereof.

Providing U-shaped turning portions allows the length of the passageways to be increased while minimizing the overall size of the plates. However, as explained in paragraph 58 on page 13 of the substitute specification, if the U-shaped turning portions of the passageways have a rectangular shape, then undesirable corners will exist in the turning portions. When the heat exchange fluid passes through the turning portions with these corners, the fluid will tend to collect in the corners thereby hindering the flow of the fluid. As a result, the heat exchange efficiency between the passageways is reduced. In view of this problem, the first passageways and/or the second passageways of the present invention have a *substantially uniform width* along a lengthwise direction thereof so as to eliminate any corners that might reduce the heat exchange efficiency.

The Examiner asserts that the Furukawa reference clearly anticipates independent claim 30, and refers to Figures 6, 7 and 10 of the Furukawa reference. However, as clearly illustrated in Figure 7, the passageway 21A of the Furukawa reference includes rectangular bends with "corners." In this regard, it is submitted that the width of the passageway at these corner locations is significantly larger than the width of the passageways at any straight portion. Consequently, it is submitted that the Furukawa reference does not disclose first passageways and second passageways which have U-shaped turning portions, and in which the first passageways and/or the second passageways have a substantially uniform width along a lengthwise direction thereof.

The Matsunaga reference, the Damsohn reference, the Katagiri reference, and the Kawai reference also do not disclose or suggest passageways with U-shaped turning portions and having a substantially uniform width along a lengthwise direction thereof. Therefore, one of ordinary skill in the art would not be motivated to modify or combine the references so as to obtain the invention recited in independent claim 30. Accordingly, it is respectfully submitted that independent claim 30 and the claims that depend therefrom are clearly patentable over the prior art of record.

In view of the above amendments and remarks, it is submitted that the present application is now in condition for allowance. However, if the Examiner should have any comments or suggestions to help speed the prosecution of this application, the Examiner is requested to contact the Applicant's undersigned representative.

Respectfully submitted,

Satoshi MATSUMOTO et al.

By:_____

W. Douglas Hahm
Registration No. 44,142
Attorney for Applicants

WDH/gtg
Washington, D.C. 20006-1021
Telephone (202) 721-8200
Facsimile (202) 721-8250
October 7, 2003